

NON-PUBLIC?: N

ACCESSION #: 8905240440 LICENSEE EVENT REPORT (LER)

FACILITY NAME: Quad Cities Unit One PAGE: 1 OF 5

DOCKET NUMBER: 05000254

TITLE: Manual Reactor Scram Due to Relief Valve 1-203-3D Stuck Open Because of  
Steam Leakage Past the Pilot Valve and Obstruction of the Drain Orifice  
EVENT DATE: 04/17/89 LER #: 89-004-00 REPORT DATE: 05/17/89

OPERATING MODE: 4 POWER LEVEL: 010

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR  
SECTION 50.73(a)(2)(ii), 50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: Bryan C. Hanson, Technical Staff Engineer, Ext. 2147

TELEPHONE: (309) 354-2241

COMPONENT FAILURE DESCRIPTION:

CAUSE: X SYSTEM: SB COMPONENT: RV MANUFACTURER: D245  
REPORTABLE TO NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: NO EXPECTED SUBMISSION DATE:

ABSTRACT:

On April 17, 1989, Quad Cities Unit One was in the RUN mode at 10 percent of rated core thermal power following a maintenance outage. At 0330 hours, the reactor was manually scrammed due to the 1-203-3D electromatic relief valve being stuck open. This occurred while the Operating Department was performing routine relief valve testing. At 0331 hours, an Unusual Event was initiated. NRC notification was completed at 0347 hours to comply with 10 CFR 50.72(a)(1)(i). At 0753 hours, the unit was in cold SHUTDOWN, and the Unusual Event was terminated.

An investigation revealed that the cause for this event was component failure. The pilot valve showed signs of steam leakage and the drain orifice in the disc retainer of the main valve was plugged. The electromatic relief valve and the pilot valve were replaced. The electromatic relief valves are tested every six months or after maintenance. This report is provided to satisfy :  
10 CFR 50.73(a)(2)(ii) and 10 CFR 50.73(a)(2)(iv).

1900H/0604Z

END OF ABSTRACT

TEXT PAGE 2 OF 5

PLANT AND SYSTEM IDENTIFICATION:

General Electric - Boiling Water Reactor - 2511 MWt rated core thermal power.

EVENT IDENTIFICATION: Manual Reactor Scram Due to Relief Valve 1-203-3D Stuck Open Because of Steam Leakage Past the Pilot Valve and Obstruction of the Drain Orifice A. CONDITIONS PRIOR TO EVENT:

Unit: One Event Date: April 17, 1989 Event Time: 0327 Reactor Mode: 4 Mode Name: RUN Power Level: 10%

This report was initiated by Deviation Report D-4-1-89-031.

RUN Mode (4) - In this position the reactor system pressure is at or above 825 psig, and the reactor protection system is energized, with APRM protection and RBM interlocks in service (excluding the 15% high flux scram).

B. DESCRIPTION OF EVENT:

At 0327 hours, on April 17, 1989, Quad Cities Unit One was in the RUN mode at approximately 10 percent of rated core thermal power. The Operating Department was in the process of performing QOS 0201-1, Auto Pressure Relief System Manual Operation of Relief Valves RV!, when the 1-203-3D relief valve would not reseal after it was opened. The position indication on the pilot solenoid SOL! showed that the pilot valve V! was closed, but the acoustic monitor, exhaust temperature, and bypass valve positions all indicated that the valve was open. Several attempts were made to close the valve using the keylock switch on panel 901-3 PL!, but these were unsuccessful. At 0330 hours, the reactor RCT! was manually scrammed JC!. At 0331 hours, an Unusual Event per Emergency Action Level (EAL) No. 14, Failure of Relief Valve to Reseat, was initiated in accordance with the Generating Station Emergency Plan (GSEP). At 0337 hours, the Nuclear Accident Reporting System (NARS) call was made for the Unusual Event. NRC notification was made using the Emergency Notification System (ENS) at 0347 hours to satisfy the requirements of 10 CFR 50.72(a)(1)(i). At 0753 hours, the unit reached cold SHUTDOWN, and the Unusual Event was terminated by the Station Director.

The 1-203-3D electromatic relief valve (ERV), including its pilot valve, was replaced by the Mechanical Maintenance Department (MMD) under Work Request Q75124.

At 0640 hours, on April 18, 1989, the valve was returned to service. At 0830 hours, reactor startup commenced with NRC approval. At 2120 hours, per QOS 201-1, the 1-203-3D relief valve was tested satisfactorily. At 0120 hours, on April 19, 1989, the main

generator GEN! was synchronized to the grid.

1900H/0604Z

TEXT PAGE 3 OF 5

#### APPARENT CAUSE OF EVENT:

This event is being reported according to 10 CFR 50.73(a)(2)(ii), which requires the reporting of any event or condition that resulted in the condition of the nuclear power plant, including its principal safety barriers, being seriously degraded, and 10 CFR 50.73(a)(2)(iv), which requires the reporting of any event or condition that results in manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS).

The cause of this event was component failure. The relief valve stayed in the open position due to a combination of failures. The pilot valve showed signs of steam leakage past the seat, and the 1/16" drain orifice in the disc retainer of the main valve was plugged with a small piece of metal.

The main valve disc is held in the closed position by steam pressure in the balance chamber and by the main disc spring. The steam pressure is equal in each of the valve chambers when the pilot valve is closed. When the pilot valve is actuated, steam drains away from the balance chamber faster than it is supplied. The resultant imbalance of pressures produces a force which moves the main valve disc from its seat and permits steam to escape. When the pilot valve is closed, steam pressure builds in the balance chamber and causes the main valve disc to close. If steam is allowed to leak past the pilot valve seat and sufficient steam cannot be supplied through the drain orifice, adequate steam pressure may not be attained to close the main valve disc.

Based on an analysis performed by O'Donnell & Associates, the source of the piece of metal blocking the drain orifice appears to be weld spatter.

This is based on stereo-microscopic examination and the magnetic nature of the particle.

The cause of the steam leakage past the pilot valve seat is normal wear.

#### D. SAFETY ANALYSIS OF EVENT:

The safety significance for this event is minimal. All ESF actuations occurred as expected to bring the reactor to a safe shutdown condition. The relief valve closed when the spring pressure overcame reactor pressure prior to 20 psig, and the Unusual Event was terminated when the reactor was in a cold SHUTDOWN condition.

The High Pressure Coolant Injection (HPCI) BJ!, Reactor Core Isolation Cooling (RCIC) BN!, Residual Heat Removal (RHR) BO!, and Core Spray BM! Systems were available

at all times during the occurrence to supply water to the reactor vessel. However, normal reactor feedwater was adequate to control level.

The reactor relief valves are located on the steam lines upstream of the first isolation valve, and they discharge directly to the torus through dedicated relief valve discharge lines. The torus local peak temperature sensor indicated a temperature rise of less than 25 degrees Fahrenheit (deg. F) and a torus bulk temperature increase of less than 20 deg. F. Torus cooling was on before the event in anticipation of the torus temperature rise during the relief valve testing. Bulk torus temperature did not exceed 95 deg. F.

1900H/0604Z

TEXT PAGE 4 OF 5

The 1-203-3D relief valve and pilot valve had previously been replaced and successfully tested in December, 1987, and had been successfully tested on May 15, 1988, and December 4, 1988.

Immediately after the scram, reactor pressure started to decrease. The coolant temperature dropped 200 deg. F from 0330 hours to 0430 hours. Technical Specifications (T.S.) were not violated by this cooldown rate. T.S. 3.6.A.1 limits cooldown to 100 deg. F per hour except as specified in T.S. 3.6.A.2. This specification allows for a step reduction of 240 deg. F as long as T.S. 3.6.A.3 is met. T.S. 3.6.A.3 requires the shell flange temperature be within 140 deg. F of the shell temperature. The 100 deg. F per hour cooldown was exceeded, but the 240 deg. F step change and the 140 deg. F differential temperature limit were not exceeded.

The thermal cycle analysis for the vessel allows for one Relief Valve Blowdown. This is the second event to be counted against this item. An event similar to this occurred on August 8, 1980. General Electric (GE), with Commonwealth Edison's BWR Engineering (BWRE) concurrence, has addressed thermal cycle concerns and concluded that there were no adverse structural integrity effects as a result of this event. GE has indicated that the thermal cycle analysis can be revised to provide for a larger number of safety relief valve blowdown (SRVB) transient cycles based on a finite element analysis of fatigue usage associated with the transient.

#### E. CORRECTIVE ACTIONS:

The immediate corrective action was to replace the 1-203-30 electromatic relief valve, including its pilot valve. Additionally, the pilot valves for the 1-203-3B and E electromatics were replaced as a preventive measure. The 1-203-3B and E valves were successfully tested on April 18, 1989. The 1-203-3C pilot valve had been replaced on April 16, 1989.

Procedure QMMP 203-22, Electromatic Relief Valve Disassembly, Inspection, Repair and Reassembly, will be revised to include a check off step to verify the drain orifice in

the disc retainer of the main valve is clear (NTS 2542008903101).

A representative of Dresser Industries, manufacturer of the ERVs, was present at the valve disassembly and assisted with the root cause analysis. He will provide a report detailing any further actions or preventive maintenance activities that can be implemented to enhance the reliability of the ERVs and pilot valves (NTS 2542008903102).

GE will update the thermal cycle analysis to provide for a larger number of safety relief valve blowdown (SRVB) transient cycles based on a finite element analysis of fatigue usage associated with the transient (NTS 2542008903103).

Further analysis will be performed on the piece of metal found in the drain orifice to attempt to determine more specifically where it originated from. Any significant findings will be reported in a supplement (NTS 2542008903104).

#### F. PREVIOUS EVENTS:

There have been three previous events involving a stuck open relief valve since 1980. All three of the failures resulted in the manual shutdown of the reactor, and all of the failures were attributed to steam cutting or binding of the valve pilot spool. There are no previous instances of relief valve failure due to plugging of the drain orifice.

1900H/0604Z

TEXT PAGE 5 OF 5

DVR 4-1-83-082 "Unit One Target Rock Safety Relief Valve 1-203-3A LER No. 83-35 Stuck Open." The reactor was scrammed after indication showed the 1-203-3A relief valve had not fully reseated following routine testing. The valve reseated when reactor pressure reached 360 psig. The cause was erosion on the pilot valve seat.

DVR 4-1-83-050 "Auto Blow Valve 1-203-3E Stuck Open." The 1-203-3E LER No. 83-23 relief valve came open at 60 psig during a start up. The valve could not be closed, and the reactor was scrammed. The cause was a binding pilot valve.

DVR 4-1-80-058 "Electromatic Relief Valve 1-203-3B Failed to Close." Scrammed the reactor during shutdown for refuel outage because 1-203-3B stuck open due to excessive steam cutting on pilot valve seat. The relief valve reclosed at 190 psig.

A Nuclear Plant Reliability Data System search found six reportable events involving Dresser valves failing open at the three other nuclear stations that have Dresser electromatic valves. Five of the failures were due to the pilot valve not reseating properly, and the other failure was due to dirt on the seating surface of the main disc valve.

#### G. COMPONENT FAILURE DATA:

Valve 1-203-3D is a 6-inch electromatic relief valve manufactured by Dresser Industries, Inc., Model Number 1525-VX.

1900H/0604Z

ATTACHMENT 1 TO 8905240440 PAGE 1 OF 1

CE Commonwealth Edison Quad Cities Nuclear Power Station 22710 206 Avenue North  
Cordova, Illinois 61242-9740 Telephone 309/654-2241

RLB-89-100

May 15, 1989

U.S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, DC 20555

Reference: Quad-Cities Nuclear Power Station Docket Number 50-254, DPR-29, Unit One

Enclosed is Licensee Event Report (LER) 89-004, Revision 00, for Quad-Cities Nuclear Power Station.

This report is submitted in accordance with the requirements of the Code of Federal Regulations, Title 10, Part 50.73(a)(2)(ii): the licensee shall report any event or condition that resulted in the condition of the nuclear power plant, including its principal safety barriers, being seriously degraded, and Part 50.73(a)(2)(iv): the licensee shall report any event or condition that resulted in manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS).

Respectfully,

COMMONWEALTH EDISON COMPANY  
QUAD-CITIES NUCLEAR POWER STATION

R. L. Bax  
Station Manager

RLB/AAF/djb

Enclosure

cc: R. Stols

R. Higgins  
INPO Records Center  
NRC Region III

1900H/0604Z

\*\*\* END OF DOCUMENT \*\*\*

---